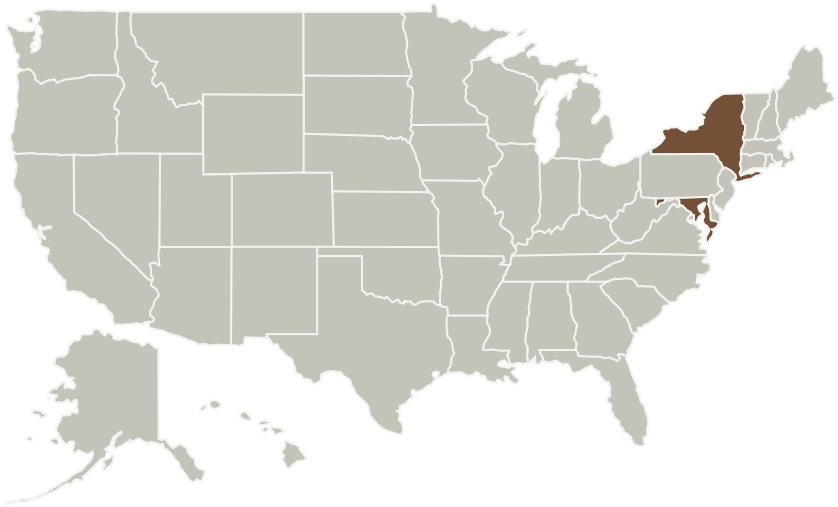
Development of a Drift-bar CZT Calorimeter with Good Energy Resolution for Gamma-ray Spectroscopy

Completed Technology Project (2016 - 2019)

Project Introduction

We propose to develop, fabricate and test a three-dimensional, high-energy-resolution, high-efficiency calorimeter for photon energies 0.2 – 10 MeV, based on novel drift (Frisch-grid) bar CdZnTe (CZT) detectors recently developed at Brookhaven National Laboratory (BNL). This calorimeter will have a position resolution of 0.1 – 0.5 mm along each of 3 axes depending on the incident photon energy, energy resolution of ~1%, and capability of operating in ambient conditions. The drift-bar approach will allow the use of CZT detectors with poorer quality, which can significantly increase the yield of acceptable detectors and consequently reduce the cost. This technology represents a breakthrough, because it promises excellent performance with large area detectors at a reasonable cost. The proposed efforts will combine the strong expertise of the BNL team in CZT detectors with that of the GSFC team in the design of space instrumentation. The immediate application of this technology is in medium-energy gamma-ray telescopes (e.g. ComPair or ASTROGAM), whose high scientific potential has been emphasized by results at lower energies (Swift, NuSTAR) and higher energies (Fermi Large Area Telescope). In particular, the drift-grid CZT detector will enable a medium-energy gamma-ray instrument to: (1) provide incident photon energy measurement with high resolution, including the capability to measure cosmic nuclear lines; and (2) serve as a focal plane detector for Compton-scattered events to determine the direction and polarization of incident photons.

Primary U.S. Work Locations and Key Partners



Development of a Drift-bar CZT Calorimeter with Good Energy Resolution for Gamma-ray Spectroscopy

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Astrophysics Research and Analysis

Development of a Drift-bar CZT Calorimeter with Good Energy Resolution for Gamma-ray Spectroscopy

Completed Technology Project (2016 - 2019)

Primary U.S. Work Locations	
Maryland	New York

Project Management

Program Director:

Michael A Garcia

Program Manager:

Dominic J Benford

Principal Investigator:

David J Thompson

Co-Investigators:

Alexander A Moiseev
Gianluigi De Geronimo
Keith M Jahoda
John F Krizmanic
Makoto Sasaki
Aleksey E Bolotnikov
Ralph B James

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System